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bart impact program

DEVELOPMENT OF METHODOLOGY FOR THE ASSESSMENT OF BART'S IMPACTS UPON ECONOMICS AND FINANCE RESEARCH PLAN

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*Metropolitan transportation San Francisco
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The BART Impact Program is a comprehensive, policy-oriented study and evaluation of the impacts of the San Francisco Bay Area's new rapid transit system (BART).

The program is being conducted by the Metropolitan Transportation Commission, a nine-county regional agency established by state law in 1970.

The program is financed by the U.S. Department of Transportation, the U.S. Department of Housing and Urban Development, and the California Department of Transportation. Management of the Federally-funded portion of the program is vested in the U.S. Department of Transportation.

The BART Impact Program covers the entire range of potential rapid transit impacts, including impacts on traffic flow, travel behavior, land use and urban development, the environment, the regional economy, social institutions and life styles, and public policy. The incidence of these impacts on population groups, local areas, and economic sectors will be measured and analyzed. The benefits of BART, and their distribution, will be weighed against the negative impacts and costs of the system in an objective evaluation of the contribution that the rapid transit investment makes toward meeting the needs and objectives of this metropolitan area and all of its people.

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BART IMPACT PROGRAM

DEVELOPMENT OF METHODOLOGY FOR THE ASSESSMENT OF BART'S IMPACTS UPON ECONOMICS AND FINANCE RESEARCH PLAN



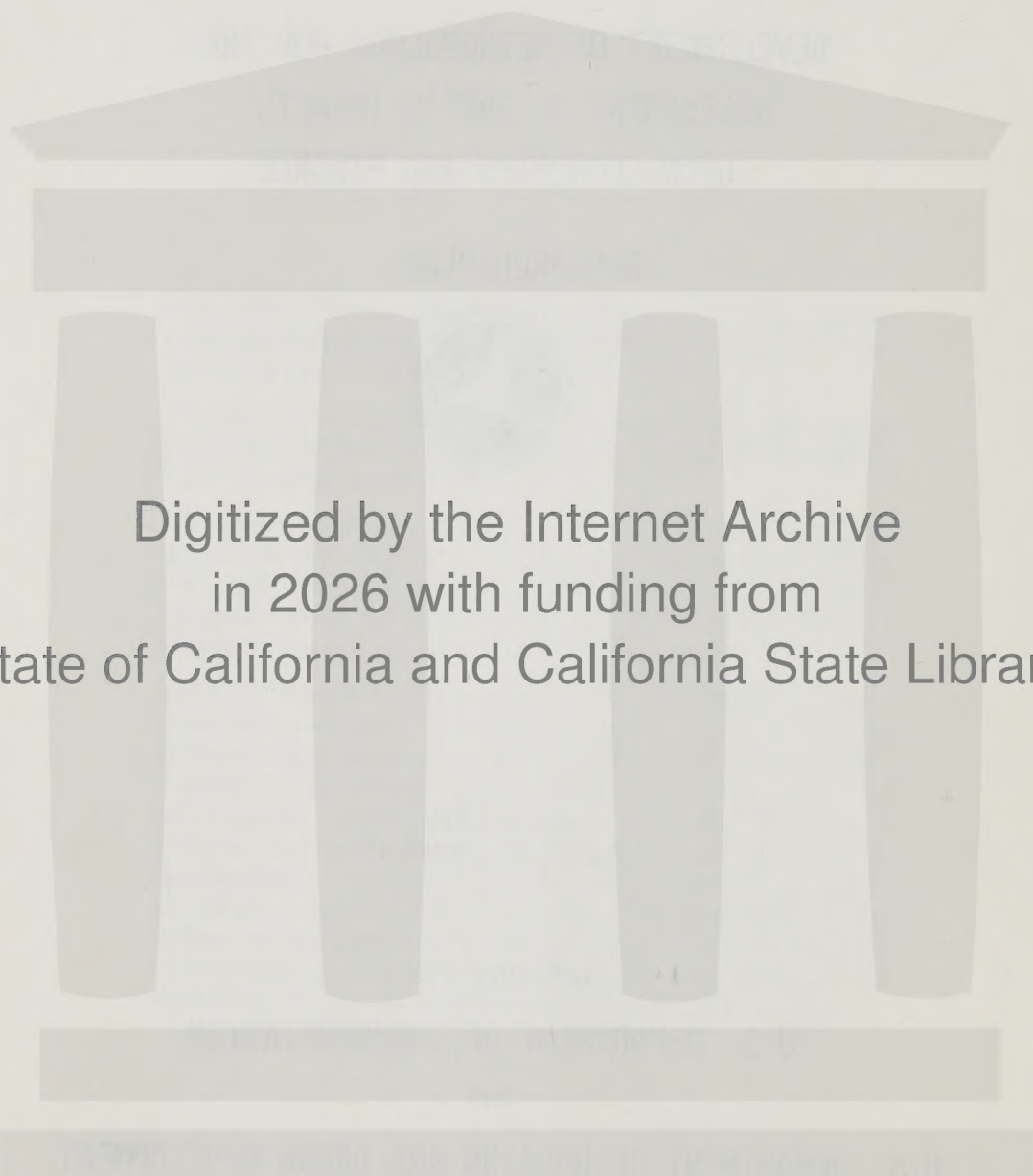
MARCH 1975
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PREPARED FOR

U.S. DEPARTMENT OF TRANSPORTATION

AND

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT



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16. Abstract This is a research plan for the Economics and Finance Project, one of the six major components of the BART Impact Program, a comprehensive, policy-oriented study and evaluation of the impacts of the San Francisco Bay Area's new rapid transit system. The Economics and Finance Project will determine the impacts of the construction of BART, the transportation service it provides, and the bond issues and taxes that finance it, on the regional economy and on specific economic sectors. It will also assess impacts on employment, productivity, business activity, the cost of public borrowing, public willingness to incur debt for other purposes, and the distribution of tax burdens among socioeconomic sectors of the population. In the Research Plan, one or more work elements are defined for each of the enumerated factors. The discussion of each element includes a description of a model of the determinants of the impact, expectations as to measurability of the impacts, a consideration of alternative study methodologies, and a recommendation of a preferred methodology.			
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I. Introduction: The Regional Economy, Processes, and Impacts to be Studied

A major investment project, such as BART, has many effects beyond its primary transportation function. In the BART Impact Program an attempt is being made to identify those attributes of the decision process and activities associated with the construction and operation of BART which have such effects. This study is devoted to the set of economic and financial aspects of BART, which are of interest to all those who wish to understand the impact of such a major project within a regional economy. The economic and financial impacts discussed in this report are, at the same time, some of the most obvious ancillary impacts of a major investment project which excite the interest of a wide segment of the general population, businessmen, and public officials as well as some of the most difficult to identify and estimate precisely. This research plan attempts to respond to the wide interest with appropriate research models and estimation methods for establishing in a systematic way both the kinds and magnitudes of these impacts. MTC has emphasized the importance of examining a full range of impacts which might be expected even if some of those impacts may be determined by the research to be conducted to be relatively small.

In order to put the individual work elements described below in perspective, some general comments about economic regions are in order. A regional economy (in both its private and public aspects) is both a reality and an abstraction. The reality is that inter- and intra-regional flows of funds, goods and services, and population set up chains of reactions which have their major effects within a fairly restricted geographic area and over fairly specific jurisdictions. The abstraction involved is that many of the economic responses produce differential effects among sub-sectors, various population groups and across political jurisdictions making it difficult to know both what the important regional boundaries are and how to aggregate the effects.

The decision to obtain funds for BART construction and operation set in motion an interregional financial flow to the Bay Area. This flow of funds leads to both inter- and intra-regional effects on both economic inputs and outputs. These in turn have secondary effects on other input and output flows. The construction and operation of the system creates intra-regional changes in the value of assets on both the input and output side, particularly on property values. These latter effects reach into the public sector: potentially affecting tax bases, tax rates, and public willingness to be taxed. Over time, the initial borrowing will be repaid in large part by local taxes and fees. This, too, involves the public sector directly in the stream of economic and financial impacts stemming from the construction and operation

of BART. These effects are the subject of this research plan.

In general terms, the economic impacts that fall within the E & F study are gross output, value added, employment, and wage levels. In addition to totals, sectoral detail may be desired for value added, output, and employment, and occupational as well as socio-demographic detail on employment and wages. The financial impacts include tax burdens; possible repercussions of tax burdens on abilities to borrow, costs of borrowing, or willingness to incur other public expenditures. These should be broken down by jurisdiction or by income level of taxpayers, where possible.

Some processes which flow from the decision to build and operate BART that may cause such impacts are:

1. Construction and procurement to build the system, initially funded with borrowed funds and grants, probably affected value added and employment in the area, in particular sectors such as construction, concrete, steel, etc. These direct effects in turn probably had multiplier effects throughout the local economy. Operation expenditures of the system also affect the level of regional economic activity.
2. Heavy demands for construction workers may have increased wages in that sector.
3. Operation of the BART system may increase the competitive advantage of the region for certain activities, and thus increase the levels of certain types of employment, such as central office functions, in the Bay Area. BART's tax burden may operate as an offset to this effect, reducing the Bay Area's competitive advantage and thus the regional levels of other types of activities in the private sector.
4. BART operations may improve the efficiency of other processes: (a) Private business in the region may benefit by improved communication between offices or plants in different parts of the Bay Area. (b) BART operations may reduce Bay Area unemployment, or improve the quality of jobs held, through improving accessibility of workers to jobs.
5. Large parts of both initial capital cost and operating deficits must be borne by residents and shoppers in the three counties served by BART, through property and sales taxes and bridge tolls.
6. These tax burdens, which reflect both current outlays and outstanding debt, may increase interest costs on future bond issues from local jurisdictions, and may reduce the willingness of citizens to approve other public expenditures.

These six processes can be "mapped" into ten work elements, which form the planned Phase II of the E & F study:

Economic Impact

Group 1: Expenditure impacts on the economy

Work element 1.1: Impact of construction and capital procurement expenditures on regional output and employment and on construction wage rates

Work element 1.2: Operation expenditures

Group 2: Impacts of the transportation service on employment and commerce

Work element 2.1: Competitive advantage of the Bay Area

Work element 2.2: More efficient business operation

Work element 2.3: Better matching of workers and jobs

Financial Impact

Group 3: Distribution of tax burdens

Work element 3.1: Tax burdens (spatially)

Work element 3.2: Tax burdens (by type of household)

Work element 3.3: Tax burdens (final incidence, by type of household)

Group 4: Fiscal behavior

Work element 4.1: Cost of borrowing

Work element 4.2: Other local public spending

Impacts that might be thought to be "economic" or "financial," but which fall outside the scope of the E & F study, include:

°Impacts on the distribution of value added, employment, residential location and wages within the nine-county area.

°Effects of BART on household expenditure patterns.

° Savings in time and money to riders of BART, and to users of other modes that become less congested.

° Any benefits of reduced pollution, increased safety, etc.

MTC has determined that these impacts, if studied, will be covered by other parts of the BART Impact Program. Given an initial, general division of labor among the six study areas, assignment of specific impacts should depend mostly on efficiency in doing the work. This in turn is largely a matter of putting tasks that require similar methodology and/or data in the same study area. For example, the distribution of economic activity and residences within the Bay Area falls within the province of the Land Use and Urban Development study (LU & UD), and thus these impacts are assigned to that study.

Taking an overall view, most of the important benefits of BART (travel time and money savings, plus most other productivity increases, improved safety, and reduced negative externalities such as air pollution) are not in the province of the E & F study. Effects on the growth of the Bay Area, which is within our scope, may benefit some Bay Area residents but represent costs to others, and from a national viewpoint are almost completely transfers. On the cost side, however, the costs of building the system and of its operating deficits do fall within the scope of the E & F study.

In concluding this section, we note that a cost-benefit study of BART is not part of the E & F Project as defined by MTC. The responsibility of the E & F study is to identify, estimate, and report on certain impacts; and also to point to ways in which the findings could be applied in making future decisions.

II. Some Theoretical and Methodological Considerations

In this section we discuss briefly two sets of considerations that affect the study design: the need for a theory of impacts, and the measurability of impacts.

Need for a Theory of Impacts

"Impact studies, whether they state it or not, attempt to establish and measure the cause and effect relationships associated with a transportation change...: (Charles River Associates, 1972, page 2-5)

The general task of the E & F Project (as of the other BART Impact Studies) is to estimate the impact of one or more given activities on the level of another activity. For example, what is the effect of BART (construction, operation, and financing) on the total number of people employed in central office functions in the Bay Area? To answer such a question requires a theory or "model" of the quantitative relationships between the causal activities and the affected variable (sometimes thought of as "multipliers").

All impact studies are based on such a model. Even the crudest "before and after" study at least partially implies such a model. For example, the E & F study could measure central office employment in the San Francisco and Oakland CBD's in 1960 and in 1975, and use the difference as an estimate of the impact of BART on central office employment in the Bay Area. Such a procedure would imply a model wherein (a) either no other activities affected central office employment, or their levels did not change; (b) BART did not affect the levels of central office employment elsewhere in the Bay Area.

The approach to measuring a particular impact depends on the state of our prior knowledge about the process causing the impact. We distinguish three different states:

1. We know both the form and the parameters of the impact process--the model is well established and the numerical values of the parameters are known.
2. The form of the model is known but the values of the parameters are not.
3. Not even the form of the model is known.

In practice these distinctions lose their sharpness. However, as examples of each possible state, consider:

1. The fiscal cost of removing property from public tax rolls for BART right-of-way, stations, etc., is equal to a given proportion of the assessed value of the property removed multiplied by the tax rate; the proportion and the tax rate(s) are known.
2. The direct and indirect impacts of BART construction on total employment in the nine-county Bay Area are equal to the product of (a) a vector of BART construction expenditures in the region, by sector; (b) an input-output inverse coefficient matrix for the region; (c) a vector of employment-output coefficients. There is no input-output table for the nine-county region.
3. The relationship between the existence of BART and the level of central-office employment in the nine-county region in a given year is not known.

In the first case, one need not measure the affected variable directly; one can estimate the impact by applying the model to the causal activity. In fact, in most cases the affected variable is also affected by other impacts, and thus direct measurement of it would not by itself be useful in estimating the BART impact.

In the second case, the usual approach is first to estimate the needed parameters; this then becomes equivalent to the first case. For example, a local input-output table can be constructed; alternatively an existing table for a somewhat larger region can be used as an approximation of the "true" local table. A different approach may be used where the affected variable has not been affected by any other impacts; in this case it can be measured directly, and changes in it attributed to BART.

In the third case, the analyst has great difficulty. Unless changes in the affected variable can be taken as caused only by BART and not at all by any other activities, the analyst must in effect specify the model and estimate its parameters by measuring all relevant causal variables as well as the affected variable. Impact studies seldom provide enough resources (not only time and money, but also number of observations and observed variance) for anything but a crude estimation of the model; the estimate often is nothing more than a guess in such cases.

In general, the paucity of knowledge about how a system such as BART affects the economic development of a metropolitan area constitutes a severe constraint on the design of the E & F study.

While the determination of some of the relevant impacts is fairly well understood, for others the conceptual framework as well as the detailed quantitative knowledge about interactions between transportation and economic growth that would facilitate such a study exists only in rudimentary form, if at all.

Among the important characteristics of such models are the following:

- The time structure (comparative statics or dynamics), and whether the system achieves a steady state that is measurable at some identifiable time or whether it is constantly adjusting. These characteristics influence (among other things) the number and timing of observations required, and the time period for which conclusions are assumed to be valid. For example, consider two different time structures: (a) Virtually all of the impact of construction might be assumed to disappear after construction activity stops, and the impact might be defined and estimated as the total impact during the period of construction. (b) The impact of BART operations on the Bay Area's competitive advantage might start with the approval of BART by the voters, and increase over time for a decade or more after full-scale operation begins; this impact might be defined and estimated as annual levels at one or more years from 1962 to the present, as well as (perhaps) one or more years in the future.
- The limits of the system in terms of geographic or jurisdictional boundaries, and population. This affects (among other things) which impacts are net and which are not. For example: the net effect of BART on central office employment is one thing for the San Francisco CBD, another (smaller) thing for the Bay Area, and a third (still smaller) for the nation as a whole.
- The alternative against which BART is to be compared. This is not a characteristic of the model, strictly speaking, but it may affect the way the model should be designed.

In this research plan, most of the analysis envisages separate estimation of BART and NBA impacts, each against a common "no-action" assumption. In a few cases, however, this is not possible, and only one net impact - that of BART against the NBA - can be estimated. "No action" means literally that no other transportation investments would be made. This assumption is useful for computation even though it is, of course, not a reflection of what actually might have happened.

Measurability of Impacts

One of the main reasons why many of the effects of a system such as BART on the metropolitan economic development are not easily predictable is that they are small in relation to other things that are happening at the same time. The present BART system, when operating at full capacity, by some estimates will handle only about 2 percent of all vehicular trips in the Bay Area. Even the tax burden imposed by BART, while far from insignificant, is only about five percent of property taxes plus about eight percent of sales taxes in the three-county area.

Accessibility and taxes, in turn, are only parts of the whole set of factors influencing decisions about where people want to live, how they allocate their time and income, and where jobs are located.

In slightly more technical language, many of BART's impacts relevant to the E & F study are likely to be small compared to the ambient "noise"--i.e., the uncontrolled and unmeasurable changes in other variables that may also cause similar impacts. This does not mean that the impacts do not exist, but it does cause grave difficulties in estimating their magnitude and direction.

III. Impacts To Be Estimated: Economic

This and the following section are the main body of the Research Plan. Ten work elements are defined. Each element is identified and discussed in turn. The discussion includes: (a) a verbal description of a model of the determinants of the impact, including the affected variables, any geographic, jurisdictional, demographic, or other breakdown of these variables, and the BART and other causal activities that determine the variables (the hypotheses to be tested about the causal influence of BART construction, operation and financing on the impact variables are implicit in the models); (b) expectations as to measurability of the impacts, alternative methodologies, and recommendations.

Work Element 1.1: Impact of BART Capital Expenditures on
Regional Output, Employment and
Construction Wages

Model: The construction of BART and the procurement of its equipment presumably increased gross output, value added, and employment in the Bay Area. The repayment, which offsets this impact to some degree, is spread over some 30 years. The direct outlays were concentrated in a few sectors, mostly in construction, cement, primary metals, metal products, non-electrical machinery, and electrical machinery. The direct impacts in turn presumably caused indirect impacts throughout the regional economy. (Pang, 1973)

Construction activity also had a disruptive effect on other local activities. It appears to be too late to measure this impact, but it should be noted.

The precise impact variables are dollar values of gross output and value added, and person-years of employment, in the nine-county Bay Area, total and disaggregated by industrial sector, over the period of BART construction. The BART activities causing the impacts are regional expenditures for construction and procurement of equipment. The time pattern of the impact is presumably during the period of expenditure only. (More about this below.)

All of these effects are offset, over time, by the impacts of the taxes imposed to repay the bonds. Bond repayments of course go to bondholders living throughout the nation. Against the increase in demand represented by BART construction and procurement expenditures in the region, there is a decrease in demand caused by the reduction in disposable income of local taxpayers. Since most of BART construction expenses will be paid for by local taxpayers, the total magnitude (but not the sectoral distribution) of these effects might come close to cancelling each other out although their sectoral distribution may well be significant. However, the time structure of the tax burden is spread over about 30 years, while the construction and procurement is concentrated over five to ten years. Moreover, any inflation subsequent to issuance of the bonds will reduce the real impact of the taxes imposed to repay them. Illustrative values of the reduced real impact due to inflation can be calculated from assumed inflation rates.

BART construction employed a significant number of construction workers. This increase in the demand for labor was satisfied, presumably, by attracting workers from other employment locally, from other regions, or from leisure (voluntary, or involuntary unemployment). This may have induced an increase in the wage

level for construction workers throughout the Bay Area. On the other hand, the increased demand may well have been met without increasing wage rates, since construction workers tend to migrate readily in response to job opportunities.

Any increases in wages in turn represented increased disposable income and hence increased aggregate consumer demand, which would have had impacts throughout the region on output, value added, and employment. Again, this increased demand, if any, was presumably offset by decreases in aggregate consumer demand as the higher wages were passed on through higher costs or lower profits to reduced disposable income of business and consumers. Thus the net effect on output and employment can be assumed to be negligible.

Methodology: In this case, (excepting wage rates) the relationship between the BART activities and the impact variables is known with reasonable precision. The impacts can therefore be estimated from existing models, and need not be measured directly. Indeed, direct measurement of the impact variables would not be useful, because they are affected by so many other variables.

An input-output table for the Bay Area can transform measurements of BART construction and procurement expenditures into total (direct and indirect) impacts in terms of gross output, value added, and employment; the impacts can be estimated in total and by industrial sector. This has already been done, for expenditures and commitments up to June 1972, using a model of a larger, 12-county area that includes the nine Bay Area counties plus Yolo, Sacramento, and San Joaquin. (Pang, 1973; Lofting and Tchobanoglous, 1972). The E & F study should include review of this work, revision to include expenditures and commitments after June 1972 if they are significant, and perhaps re-estimation using an input-output table for the nine-county area only. (The value of this last refinement seems doubtful, but the E & F contractor may wish to consider it.)

Alternatively, a much simpler methodology could be used. The measurement of total direct expenditures in the region could be transformed to total direct plus indirect effects on regional output, value added, and employment through the use of simple multipliers, which could be simply estimated from the input-output table or from analogous data. Given the existence of the input-output table and the Pang study, as well as the need to use input-output methods in other tasks, however, reversion to this simpler method does not seem appropriate.

If an estimate of the time pattern of these impacts is also desired, a dynamic macro-economic model of the Bay Area can transform total local BART construction and procurement into impacts on total local income and employment, over time. Such

models seldom give much sectoral detail. At least one such model is available, at Economics Science Corporation. This model gives quarterly estimates. (See Roberts, 1974.) We have not investigated the performance of this model. The main purpose of this analysis would be to estimate details of the time profile of the impact; the analysis would also estimate impacts of some other variables. On balance, we do not see the need for such analysis; however, we recommend that the E & F contractor form his own judgment on the issue.

Additional detail on the distribution of employment by occupation, racial or ethnic groups, and wage level will also be of interest. Input-output and auxiliary techniques can be used to give an occupational breakdown. Average wages by industry and by occupation are available from standard Census or Social Security sources, and these can be used to estimate the wage distribution of employment induced by BART construction procurement. Racial or ethnic breakdowns would have to be measured directly, from data kept by employers, if such exists.¹ Only direct impact could be measured in this way; indirect impacts would have to be omitted. Wage and occupational breakdowns could also be measured directly, in the same way.

A model of local wage determination that would yield accurate estimates of BART's impact on construction wages rates is not available, as far as we know. We recommend estimating a first approximation, at low cost, by observing annual data on the ratio of Bay Area construction wage rates to national average construction wage rates. If the data show a statistically significant upward deviation from the trend during the period of BART construction, then that deviation might represent a BART impact. Unfortunately, the same period also saw a boom in building construction, at least in San Francisco's CBD. If construction activity other than BART in the Bay Area as a whole also was unusually high (compared to the national level) during the period, then separating the effects would be virtually impossible even if there is a BART impact. (We do not assume that most or all of the construction other than BART was itself caused by BART.)

Key-informant interviews with both construction contractors and union leaders can help in interpreting the statistical results.

To estimate the impacts of the NBA, the TS & TB² study will have to specify the construction and procurement expenditures for the NBA, and analogous calculations can be made. These will and should be done with less disaggregated detail than is available for the BART impact.

¹Recent information from BARTD indicates that incomplete records do exist, but they are scattered and would require several person-weeks to extract from the files and tabulate in useable formats.

²Transportation System and Travel Behavior

Since the construction of the NBA would probably have been spread over a longer time, we recommend assuming that its impact on the wage level would have been smaller than BART's impact and may be negligible. For estimating net impacts, the BART impact, if any is identified, should be used.

Work Element 1.2: Impacts of BART Expenditures for Operation on Regional Output and Employment

Model: BART's operation causes impacts in the same way as does its construction. BART employs people, lets contracts, purchases equipment, etc.

In this case, the offsetting reduction in demand, caused by paying for these costs through fares and taxes, has a time profile similar to the expenditures. The net total effect in any given year is therefore probably very small and very difficult to measure accurately. Effects in particular sectors may be significant, but would be hard to measure accurately.

These same conclusions apply to the impact of NBA operations.

Methodology: Since the aggregate impacts are likely to be very small, we see no purpose served by using an aggregate approach. The sectoral details of the impacts (BART & NBA) are likely to be significant, however. It is possible, for example, that BART will be more labor-intensive than NBA in the operation phase. We therefore recommend estimation be done analogously to the method recommended in Work Element 1; viz., input-output. Insofar as the impacts are associated with income classes, household expenditure patterns would provide some additional information on sectoral distributions, and should be considered in the E & F study.

The BART annual operating budget of at least \$60 million can be expected to generate direct and indirect impacts of perhaps \$200 million of gross regional output and several thousand person-years employment annually. The impact of the NBA would be of similar magnitude; perhaps somewhat higher.

In both the BART and NBA cases, offsetting reductions, caused by the fares and taxes to pay for BART operations, would be about equal to the impacts mentioned.

The role of BART as one of the region's large employers, with an affirmative action program that has been under close scrutiny, is of interest to people here and elsewhere. An examination of the distributional origins of BART's employees, socio-economically and by industrial sector, will be included.

Work Element 2.1: Impact on Competitive Advantage of the Bay Area

Model: The BART system, by providing efficient commuter and other transportation service, may increase the attractiveness of

the Bay Area for people and for certain types of employment. This impact may act both through employers, who decide to locate in the Bay Area rather than somewhere else, and employees, who prefer to live and/or work in the area served by BART rather than elsewhere. Each of these impacts, if they exist, will reinforce the other. (Muth, 1971; Olvey, 1972; Greenwood, 1973).

Here again the tax burden of financing may have an offsetting effect. In the case of BART, however, the offset is probably virtually nil, especially in the case of employer motivation. This is because the negative effects are likely to be significant, if at all, only on land-intensive types of manufacturing. Such activities tend to locate far from central cities in any case, and in the Bay Area there are six counties in which they could locate where BART tax burdens are zero. The positive or attractive effect, on the other hand, is most likely to be significant (if at all) for exportable non-manufacturing activities (e.g., tourism, central office-type employment), which is thought to be quite insensitive to local tax levels.

The time profile of this impact is complicated. The impact, if any, probably started when the decision to build BART was taken, and may continue to be felt for decades. Moreover, the affected variable is one that may never achieve a steady state level, but rather is always adjusting to one impact after another. In sum, this impact is an instance of both weak theory and of BART impacts that may be small compared to those of other activities.

The general question of the impact of a system such as BART on regional competitive advantage and economic development is much talked about, but never verified. Many people who have studied transportation and economic development believe that the impact of BART on the economic development of the San Francisco Region, and the impact of most or all other potential new BART-like systems on U.S. cities that do not have rail rapid transit, is both small and unmeasurable. For this reason, we recommend a serious attempt to quantify this impact, even though we expect the conclusion to be that it is small and perhaps unmeasurable. Conclusions of a careful study of this type of impact in San Francisco would be quite useful in discussions of transportation proposals elsewhere.

Methodology: We recommend a combination of two different approaches: Statistical analysis can at least describe what is happening, while interviews can help to separate spurious correlation from causation. The methodology might be as follows:

1. Key informant interviews: select, from Dun and Bradstreet tapes on shifts in plant location or a similar data set, a sample of exportable non-manufacturing activities that have located in the San Francisco, and Oakland CBS's since BART was approved. Find out who was involved in the location decision and ask

whether other places than the (nine county) Bay Area were considered, and if so whether BART had an effect on the decision. The State Economic Development Commission and Chamber of Commerce could be interviewed, also, on perceptions of intra-California location choices. It's unlikely that anyone will answer that BART was decisive, but the importance attached to BART relative to other factors can be used to make a subjective judgment as to the impact of BART on activities that could have gone elsewhere but went to the Bay Area. Some related work was done as part of the "pre-BART" studies. (Lee, 1973) The E & F Study should review this work and expand upon it as may be appropriate.

Businesses that have moved out of the Bay Area, as well as businesses that have moved in or out of the control area(s) mentioned below, should also be interviewed to ascertain the importance of regional transit systems in their location decision. The possibility of an impact of higher taxes should be explored here.

2. Simple statistical analysis: obtain annual time series (from County Business Patterns, California Department of Economic Development, or other sources) on administrative and auxiliary and other relevant employment. Also get annual population estimates. Get for (a) nine-county Bay Area; (b) one or more "control" areas, such as Los Angeles, and other regional centers such as Boston, Atlanta, Chicago, and New York; (c) Nation. Form employment per capita ratios and see if the San Francisco ratios went up around 1962, and stayed up relative to U.S. and to control areas. The impact estimate to be used should probably be defined as the level of employment in one recent year. (Which year would depend on the data used.) Estimating a time profile of the impact, or projecting it into the future, seems too unreliable to be worth doing.

The main practical difficulty in this procedure is the selection of control areas. The rest of the nation is clearly unsatisfactory; Los Angeles and southern California may be as good as any but are also unsatisfactory as exact controls. We know of no good solution to this problem within the possibilities of the BART Impact Program; the results must simply be regarded with great caution.

In summary, a rough estimate of the impact can be made from these two approaches. Even though the estimate is likely to be rather unreliable, the question is of great interest. We therefore recommend the analysis in spite of its crudeness. We do not recommend any further analysis based on the estimate, such as indirect effects, time profiles, etc.

Since the NBA is to be defined as an adequate and sensible alternative to BART, the impact that will be estimated by the recommended procedure is the net impact of BART relative to the NBA. Separate estimates of each are not possible.

Additional Note: Yet an additional possibility that the Phase II contractor should consider is the following question: Given one or more developmental goals, what policies would maximize BART's contribution to the goals? For example: if maximum growth of central office employment is a goal, what complementary actions should be taken to enhance BART's impact? This type of question, in general, is "how to design policies, given a desired impact and the existence of BART?" rather than "what is the impact, given the policies?".

Work Element 2.2: More Efficient Operation of Bay Area Business

Model: Increased accessibility due to BART might improve efficiency through easier trips between different office locations for face-to-face meetings, parcel delivery, etc. Such benefits are probably small and difficult to measure.

Methodology: This impact might be very roughly estimated through questionnaire surveys of BART riders which should be done by the TS & TB Project with the advice of the E & F contractor. The E & F contractor should address the implications of the results for business operations.

Work Element 2.3: Better Matching of People to Jobs Through Improved Accessibility

Model: BART may reduce unemployment, or improve the quality of jobs held, by improving the accessibility of people to jobs. This type of impact on poor minority groups is of special interest. (However, the impact may be as large or larger for other groups.)

For this impact on minority groups to exist, three things must be true. First, poor minority workers must experience more unemployment, and/or less desirable jobs, because transportation to better jobs is different, costly, or unavailable. Second, BART must provide better transportation from minority residences to better jobs. Third, minority people must get those jobs and use BART to commute to them.

Recent studies have found no convincing evidence that transportation accessibility to jobs has a significant effect on employment or wages of poor minority groups. While it is true that jobs have been suburbanizing faster than poor minority residences, the employment and wage experience of poor minority workers does not appear to depend on the location of their residence, if their education, age, and sex are separately accounted for. Thus, the importance of this impact, for BART or for any other transportation systems, seems very doubtful. (A good review is in Harrison, 1972 and 1974. For an earlier contrary view see Kain, 1968. See also Hutchinson, 1974; Mooney, 1969; Danziger and Weinstein, 1974; Goering, 1971; Greenwald and Syron, 1969; Wohl, 1970; Piovita et al, 1973; American Academy of Arts and Sciences, 1968.)

The second requirement for the impact, improved accessibility, may also be doubtful but can be measured. The locations of target minority groups' residences can be identified, as can the location of relevant employment. Accessibility through BART, and through the NBA, can be estimated. (This should be done with the help of the TS & TB study, using the models of the transportation networks they design.) It is possible that the NBA might well provide better access than BART for these people-job combinations.

The third item is also doubtful. Demonstrations in Watts and elsewhere suggest strongly that even when improved accessibility through public transit is used as part of a package to improve minority individuals' jobs, the individuals soon buy cars and stop using the transit facilities. (Crain, 1970)

This discussion does not imply that no individuals will get better jobs because of increased accessibility caused by BART.

Nor does it imply that no poor minority individuals will benefit in this way. It does imply that a significant impact of this sort on the poor minority population of the region, or even on that part of the poor minority population living near BART stations, is unlikely. The net effect of BART relative to a reasonably mass-transit-oriented NBA is even less likely to be significant.

Methodology: Here again, however, we recommend a strong effort to document any impact of this type, since it is a subject that comes up in connection with all urban transportation, but remains unresolved. The failure of a strong objective attempt to find an impact might be useful in designing transportation systems for other cities as well as in future plans in the Bay Area.

Both the accessibility and the mobility estimates should clearly be done as part of the TS & TB study. The overall approach to the study and analysis of this element should be coordinated between the E & F and the TS & TB contractors.

The impact, if it exists, is probably very small relative to other labor market forces. To guess at an upper-limit estimate, assume BART carries 10 percent of all Bay Area commuter trips, and that 10 percent of BART commuters have gotten better jobs because of BART accessibility. Thus one percent of commuters -- say one percent of the labor force -- might be affected. This is a gross impact; other workers may have been adversely affected. When the NBA is considered, the net-net effect may well be very close to zero (or even negative, if the NBA provides greater accessibility for groups where mis-matching is most severe).

Note: Here again, the TS & TB contractor and the E & F contractor should cooperate on preliminary studies of how BART's favorable impacts on minority groups would be enhanced.

IV. Impacts to be Estimated: Financial

General Remarks

This section deals with the effects of BART on the fiscal situations of citizens and governments in the region. The objectives of work elements discussed in this section include the estimation of tax payments by households and firms as well as total tax burdens imposed on taxpayers of the area and the nation.

This will respond to the question of "who pays for BART?"

The estimation of possible effects of this increased tax burden in the form of reduced spending for other public services, and reduced ability or higher cost of local governments for borrowing in the capital market are the subjects of other work elements in this section.

Work Elements 3.1, 3.2, and 3.3 deal with the first-order impacts of the taxes that pay for BART, on local taxpayers. Elements 4.1 and 4.2 deal with impacts on the fiscal situation or the fiscal behavior, of local governments. Some of these latter impacts can be estimated with reasonable accuracy, while others cannot.

Among the fiscal impacts of BART are those which could be attributable, at least in part, to aggregate changes in the regional economy, and those which are attributable to redistribution within the region. Both public revenues and expenditures change as a result of redistribution of households and firms within the Bay Area, regardless of any aggregate economic growth that may have been induced by BART. Aggregate growth, if any, will also have fiscal effects. For purposes of this study, we suggest that the fiscal impacts be calculated under the assumption of zero net effect of BART on the nine-county region's population and employment growth. As explained earlier, this assumption is probably quite close to reality, and establishing the accuracy of a non-zero value would be quite difficult.

Moreover, this assumption greatly simplifies the fiscal impact studies. If, however, future research demonstrates that immigration and economic growth was induced by BART, this factor will be taken into account when considering fiscal effects.

The following spatial divisions are recommended for the fiscal impact work elements. The list represents the total set of divisions; most work elements should consider only a relevant sub-set.

1. San Francisco and Oakland (central city)
2. Richmond and San Leandro (lower-income area with a large industrial base)
3. Walnut Creek (affluent, primarily residential suburban jurisdiction)
4. Berkeley (special combination of mixed residential and commercial; higher tax load due to locally-financed undergrounding of BART tracks)
5. Three-county area paying for BART
6. Other six counties of nine-county region
7. Daly City (community benefitting from proximity of BART station where residents are not taxed for the system)
8. State of California
9. Balance of Nation

The following years are significant in examining fiscal effects of BART:

- 1961 - one year prior to general obligation bond approved by voters
- 1962 - (April) - report of \$792 million estimated cost
- 1962 - (November) - approval of this outlay by voters in three counties
- 1965 - Issuance of \$100 million San Francisco Bay Toll Bridge Revenue Bonds
- 1969 - Legislation by State to authorize borrowing additional \$150 million, to be repaid by 1/2 of 1 percent sales tax
- 1969 - (August) - last general obligation bond offered
- 1970 - Sales tax first applied
- 1972 - First section of BART operational
- 1974 - (May) - State legislation to continue 1/2 of 1 percent sales tax to cover operating deficit.
- 1974 - (September) - Total BART system operational (?)
- 1999 - BART general obligation bonds payment completed

The years selected for specific tasks will vary. Two key dates for much of the analysis, however, will be 1961 and 1975. Although BART has been discussed since the mid-1950's, it is unlikely that any of its fiscal effects were taken into account

until early 1962. Thus, 1961 should be the pre-BART base year. Total BART fiscal effects will continue indefinitely. Bonds for capital outlay will not be paid off until the 1990's, and it is not feasible to estimate the duration (or size) of future operating deficits. However, fiscal effects of both capital costs and operating deficits of BART will probably be felt during 1975, since the current size of the operating deficit should be known during that year.

The fiscal effects of BART are to be calculated spatially for political jurisdictions and for the following income level groups:

Annual household income

Under \$5,000
\$ 5,000- 9,999
\$10,000-14,999
\$15,000-24,999
\$25,000 and over

The recommended income groups are consistent with the 1970 Census of Population groups, although more aggregated for incomes below \$10,000. In 1974, most households below \$5,000 were considered to be low-income; thus, there is little need for more detailed income groups.

For each income level group, impacts should be calculated separately for homeowners and renters, and for those over 65 years of age and under 65.

Since taxes are not assessed by race, direct estimates of racial incidence cannot be made. We recommend making approximate estimates using correlations of race with income and location; the 1970 census provides the necessary data.

Work Element 3.1: Direct Tax Burdens of BART Capital Outlays and Operating Deficits (by Spatial Areas)

Model: A large proportion of BART capital outlays and operating deficits are paid by property and sales taxes levied primarily on the residents of the three counties, and by tolls on the Bay Bridge. The rest are paid for primarily by residents of the balance of the nine-county region, the rest of the State of California and the rest of the nation in descending order of magnitude.

Aggregate outlays as well as annual expenditures for selected time intervals are of great interest. In addition, for estimating absolute and per household burdens, the burden as a percent of total tax burdens and as a percentage of regional income is of interest. Results should also be compared to the values predicted by BART planning studies.

Methodology: Expenditures for BART should first be grouped by source of funding. Property tax payments will be directly attributable to each county in the three-county area. Sales taxes are paid primarily by residents and firms in the three-county area; however, part of the sales tax is shifted to residents outside this sub-region via their purchase of goods, and thus attributed to the balance of the nine-county region or the nation. The proportion of purchases from outside the three-county area can be expected to be small. Rough estimates should be based on whatever data may be available on shopping patterns. Data on tourism collected by the City of San Francisco should be used to estimate sales to non-area residents.

Data on inter-county traffic patterns by county are available from transportation studies and can be applied to estimate the place of residence of those paying bridge tolls. (Bay Area Transportation Study Commission, 1969.) In addition, the payments by commercial vehicles should be estimated.

Part of the state and federal outlays should be allocated back to the region on the basis of regional payments. The three-county region bears about 1.5 percent of the total federal tax burden and over 10 percent of state taxes. Thus, its residents are paying part of state and federal outlays for BART. Businesses located in the region, also, pay part of the state and federal outlays in corporate taxes. The netting out of this is difficult since some portion of these taxes is passed on to consumers in the region and outside it.

For the same spatial areas, the likely sources of funding for capital outlays for the NBA must be specified, but are likely to be state and federal funds. Given the physical characteristics and cost of the NBA, to be provided by the TS & TB study,

the E & F contractor should estimate the most likely structure of funding based on legislation and practices common at that time that the alternative would have been implemented. The primary allocation will be the share of federal, state, regional, and local public funds, and user costs. For example, an additional Bay Bridge would presumably be paid for from user charges, a freeway expansion would involve primarily state and federal funds, and bus subsidies would be paid locally. There are usually differences between capital outlays by state and federal governments, which are paid from current revenues, and local payments, which are paid by incurring long-term debt.

The major sources of funding for BART are the residents and firms of the three-county area. Within the area, per capita payments are not expected to show much variation by jurisdiction. The average magnitude of the burden per capita is about \$100 per household per year. (Peat, Marwick, and Mitchell, May 1974). The operating subsidy will add \$20 or more. A more accurate estimate may be possible by the end of 1974.

Work Element 3.2: Direct Tax Burdens of BART Capital Outlays and Operating Deficits (by Income Group)

Model: In addition to estimating payments by political jurisdiction, it is important to estimate the incidence of those same BART tax payments, for households by income level in the three-county region. In addition, the share BART outlays represent of the total local tax burden should be estimated. As in the previous work element, indirect effects of changes in tax bases and expenditure patterns should be noted but not incorporated in the calculations.

The objective of this analysis is to estimate direct payments by households rather than the final tax incidence of these payments; the latter is estimated in Work Element 3.3.

Methodology: The two types of tax must be estimated separately:

1. Property tax: For owner-occupied property, the BART tax rate times the estimated assessed-to-market value ratio of housing units for each income group can be calculated. (The assessed-to-market-value ratios should not be the state-mandated relationship, but rather ratios based on empirical data. For example, the 1971 assessment ratio in Contra Costa County is 16.7 percent of market value, rather than the state-required 25 percent. See 1972 Census of Governemnt, Vol. 2, Part 2.)

For rental property, ratios of rent payment to income can be obtained from sources such as the Census of Population. The proportion of rent payments allocated for property taxes can be estimated by converting annual rent payments to rental unit property values. For this item, we suggest the assumption that be modified in the next work element, which is to estimate final tax incidence. (It is recognized that the renter does not directly pay the tax; however, we include this as a "direct" effect.)

Additional breakdowns by age, owner-renter, and racial-ethnic groups, as discussed earlier, should be estimated.

2. Sales tax: Payments by residents of the three-county area should be estimated on the basis of the proportion of expenditures by income class for items subject to the California sales tax. The impacts of the NBA can be calculated in the same way.

The distribution of the burden has already been estimated, as follows: (Peat, Marwick, Mitchell, and Co., 1974)

Gross Household IncomeAnnual Tax Burden*

\$ 5,000	\$ 35
\$10,000	\$ 62
\$15,000	\$ 78
\$20,000	\$103
\$30,000	\$151
\$40,000	\$200

*Does not include operating deficits.

The E & F contractor should review these estimates before making new ones.

Work Element 3.3: Tax Burden of BART Capital Outlay and Operating Deficits (Final Incidence)

Model: In the previous two work elements, the amount of direct payment levied on households in the three-county area to pay for BART is to be estimated. These estimates are of considerable importance, since they involve the initial and thus visible points of tax liability of households. However, this approach did not take into account property tax payments by commercial and industrial enterprises, which represent, in San Francisco, 39 percent, and Alameda County 26 percent of all property tax payments. Moreover, for business enterprises as well as residential property, we are interested in the final distribution of burden (sometimes called "final incidence") on households in the region. Indirect effects stemming from BART impacts on the fiscal situations of local governments are not to be calculated.

The question of property tax incidence on housing has been the subject of intensive debate for several decades; the debate is not yet resolved. (See several papers and the discussions in the May 1974 Papers and Proceedings volume of the American Economic Review, pp. 212-235.) Two conceptual incidence models represent the spectrum of views on this question. One demonstrates why the property tax burden is likely to fall ultimately on capital; i.e., the owner pays the tax. The second model demonstrates why the incidence is likely to fall mostly on consumption; i.e., the occupant pays the tax. The view that the property tax is a tax on the owner assumes a uniform national tax, perfect mobility of capital, etc. Since the BART property tax is an increment to taxes in areas where effective tax rates prior to BART were already considerably above the national average, we consider that the true state of affairs is closer to the second assumption, i.e., that the ultimate incidence falls mostly on the occupant. This latter approach implies that the direct impacts estimated in work elements 9 and 10 are good first approximations of the final impacts. However, there is agreement that the tax on land, which probably accounts for one-quarter of the three-county taxable property base, cannot be shifted forward to occupants. The degree to which taxes on structures can be shifted depends on vacancy rates, level of competition, the presence or absence of rent controls and related factors.

Methodology: Given that the debate is unresolved, the E & F contractor will have to proceed by making reasonable assumptions about shifting. For rental property, a reasonable assumption might be something like two-thirds shifted to occupants; one-third to owners. If specific communities have characteristics which deviate from the national or regional pattern (above average vacancy rates or rent control) these assumptions can

be modified. For example, given rent control (as in Berkeley) with the provision that property tax increases can be shifted fully to renters and close to zero vacancy rates, we can assert that the property tax is fully shifted forward. For owner-occupied housing, of course, the assumption is irrelevant.

It should be recognized that any such allocation is somewhat arbitrary and will not satisfy every reader. For this reason, a sensitivity analysis should be undertaken which compares the impact of alternative assumptions on tax incidence for the selected income groups.

For non-residential property, one needs to estimate two parameters: what share of the tax burden is shifted to households outside the three-county region, and how the balance should be allocated between consumers and owners of capital.

Commercial enterprises that serve the local market probably pass the property tax on to consumers. (This assumption may not be valid for a few enterprises on the border of other jurisdictions.) For industrial enterprises that serve a national market, the degree of shifting will depend on their competitive position. A reasonable assumption might be that half the tax is shifted to non-area residents.

Since most of the sales tax in California is paid by consumers, the incidence falls primarily on consumers of the products subject to the tax. Purchases by business firms account for no more than twenty percent of all sales subject to the tax. The E & F project should determine if the twenty percent share by business firms holds in California at the time the study is conducted. If the percentage is applicable in the state, it should be applied uniformly.

Personal income tax offsets also need to be calculated. The property and sales taxes are deductible from both federal and state income taxes. These deductions should be applied uniformly.

Tax incidence should be computed for households in the three-county area. Since the BART tax burden differences are minor within this area, the tax incidence values will not differ substantially. The household groups previously identified should be used to illustrate tax burdens. 1975 would seem to be an appropriate year; projections into the future would require assumptions about operating deficits (and since the burden as a percent of income is to be estimated, about inflation rates) and are therefore of lesser value. Again, the impacts of the NBA can be calculated in the same way.

Magnitude: The expected magnitude can be illustrated by the following example: What does a household earning \$20,000 per annum, residing in a \$45,000 owner-occupied housing unit in Contra Costa County pay for BART in 1974? This household would

pay about \$55 in property taxes, and \$45 in sales taxes, or \$100 directly (before offsets). An additional \$20 or so would be shifted to this income group to reflect its ownership of capital in the form of industrial and commercial property in the Bay Area. Shifting half the property tax burden on rental housing to owners of capital would probably result in a slightly higher tax burden for the \$20,000 income groups. In sum, it appears that \$100-\$130 reflects the magnitude of annual impact for middle and upper-middle income households. It is likely that the combined taxes will be roughly proportional to income if income tax offsets are incorporated.

Since past studies have examined tax incidence under various assumptions by income groups, much of this work can be adopted. (See, e.g., Rostuaold, 1966).

Work Element 4.1: Impact of BART Bonded Debt on Cost of Future Borrowing

Model: BART bonded debt, by increasing the total amount of local public debt, may have affected the costs to local governments of borrowing for the construction of other public facilities. The objective of this task will be to determine if bond ratings and thus interest rates were affected in a measurable way by BART debt.

Methodology: The approach we recommend is heavily empirical, consisting of two parallel sub-tasks:

1. Examination of changes in bond ratings for the selected jurisdictions to determine if any changes have taken place since the bonds were voted on. If any ratings were reduced, the effects on interest rates can be estimated. (It may well be that BART prevented an increase in bond rating from pre-BART levels; however, this would be even more difficult to establish.) As part of this task, data on the share of BART bond debt of total local debt in the selected jurisdictions should be gathered.
2. Interviews with officials in investment banking institutions in San Francisco and New York to determine how they evaluate the additional BART debt in rating municipal bonds in the three-county area. If sub-task (1) has shown downgrading of bonds, discuss what influence BART had, if any, on the downgrading review process.

It may be useful, as a secondary approach, to establish a debt to property base ratio and interest rates. However, the debt to property base ratio is only one of the factors determining bond ratings and interest rates.

The NBA would have involved a lower level of public debt. Its impact can be assumed to be negligible, but there seems no good way to estimate it exactly.

Magnitude: These bonds were offered over a 5 1/2 year period beginning in December 1963 and ending in August, 1969. This extended time period could have reduced the impact. Another reason for anticipating negligible impact is San Francisco's present AAA rating. The \$792 million general obligations bond debt represented, in 1971-1972, 10.9 percent of the total assessed property base in the three-county area, or about 2.5 percent of the market value of all taxable property. Other debt in the three-county area in 1972 was \$700 million, or less than BART. (Bay Area Rapid Transit District, 1972, p.17) Therefore, the BART debt could have had a measurable influence on bond ratings in the other two counties.

Again, we cannot do more than guess at this impact. At the low end, a zero cost seems plausible. For a high estimate, assume that BART increases interest cost by 10 percent on all borrowings for ten years. Assume such borrowings amount to five percent of existing debt each year, with interest costs of, say, six percent. (The relevant period is 1964-74.) The upper-limit estimate would be an annual interest cost of about an additional \$2 million.

Work Element 4.2: Impact of BART Taxes on Other Local Public Spending

Model: One concern frequently expressed by local officials is that higher property and sales taxes discourage additional public outlays. The opposite hypothesis is that each decision of voters is based on its own merit: if BART is perceived to provide more benefits than its cost to taxpayers, the bond issue would be approved regardless of other tax liabilities. If subsequently, a school bond issue fails, it does so because it is not perceived to provide sufficient benefits, rather than because of BART. Statistical studies of this hypothesis have been done, and they show that in a typical jurisdiction there is some impact of higher property and sales taxes on other spending. However, the variation among jurisdictions is so great that the present case should be studied separately. (Gramlich and Galper, 1973)

Methodology: Here again we have an impact that is extremely difficult to estimate. A sequential approach is therefore suggested to determine if BART funding had an adverse effect on the level of funding for other public services in the three-county area.

The first step should consist of interviews with key decision-makers. Frequently, bond issues are not even proposed for a vote if it is thought that voter resistance is too high. Thus, examining only bond election results may be misleading. In selected communities, key decision-makers, both elected officials and staff, should be interviewed to determine whether additional capital or operating outlays were not proposed because of high debt levels, to which BART contributed. It may be that the importance of the BART payments is a function of its visibility. Many voters, for example, may no longer realize that BART is an item on their property tax bill. One would also expect that the reduction in the BART tax rate as the tax base expands may have reduced its importance to taxpayers. There may also be sharp differences among communities. For example, Oakland is presently undergoing a fiscal crisis, and therefore its elected officials and public may be more conscious of the BART tax. Residents in more affluent communities may be less sensitive to this tax burden.

If these interviews suggest no impact, the analysis should stop. If, on the contrary, an impact is thought to exist, statistical analysis should follow.

This second step should include both cross-section and time-series analyses of selected communities in the Bay Area. The pattern of tax rate changes and expenditures (aggregate and

for public education) for a twelve-year time period 1962-1974, can be examined using regression techniques, to determine whether the addition of BART debt has influenced the pattern of outlays. The result of votes on bond issues and tax rates during this time interval would also be included as part of the analysis.

The time-series analysis would be for jurisdictions where BART taxes are levied. The cross-sectional analysis should also include jurisdictions with similar characteristics but not paying for BART, to determine if any significant differences in expenditure patterns emerge. This analysis, as well as the time-series effort, would have to adjust for differences in income, population growth and related factors. The major weakness of cross-sectional approaches is that unmeasurable difference in community characteristics may be responsible for variations in expenditures exogenous to tax burden differences.

The NBA would most likely be funded primarily by state and Federal funds. If this is true in the NBA specified, the additional tax burden for NBA would be minimal.

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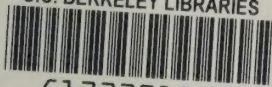
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